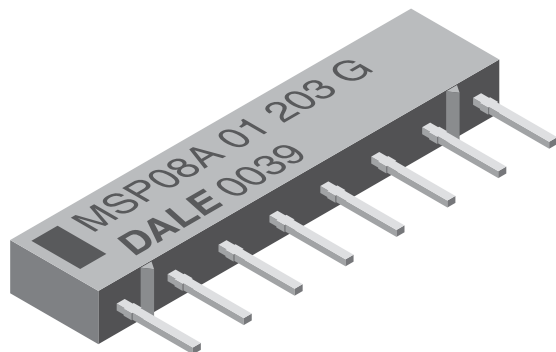


# Thick Film Resistor Networks, Single-In-Line, Molded SIP



## FEATURES

- Isolated, bussed, and dual terminator schematics available
- 0.195" (4.95 mm) "A" or 0.350" (8.89 mm) "C" maximum seated height
- Thick film resistive elements
- Low temperature coefficient (-55 °C to +125 °C)  $\pm 100$  ppm/°C
- Rugged, molded case construction
- Reduces total assembly costs
- Compatible with automatic insertion equipment and reduces PC board space
- Wide resistance range (10  $\Omega$  to 2.2 M $\Omega$ )
- Available in tube pack
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS\***  
Available

## Note

\* This datasheet provides information about parts that are RoHS-compliant and/or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information/tables in this datasheet for details.

## STANDARD ELECTRICAL SPECIFICATIONS

| GLOBAL MODEL/SCHEMATIC | PROFILE | POWER RATING ELEMENT $P_{70^{\circ}\text{C}}$ W | RESISTANCE RANGE $\Omega$ | TOLERANCE $\pm \%$ | TEMPERATURE COEFFICIENT (-55 °C to +125 °C) $\pm$ ppm/°C | TCR TRACKING <sup>(1)</sup> (-55 °C to +125 °C) $\pm$ ppm/°C | MAXIMUM WORKING VOLTAGE <sup>(3)</sup> V <sub>DC</sub> |
|------------------------|---------|-------------------------------------------------|---------------------------|--------------------|----------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------|
| MSPxxx01               | A       | 0.20                                            | 10 to 2.2M                | 1, 2, 5            | 100                                                      | 50                                                           | 100                                                    |
| MSPxxx01               | C       | 0.25                                            | 10 to 2.2M                | 1, 2, 5            | 100                                                      | 50                                                           | 100                                                    |
| MSPxxx03               | A       | 0.30                                            | 10 to 2.2M                | 1, 2, 5            | 100                                                      | 50                                                           | 100                                                    |
| MSPxxx03               | C       | 0.40                                            | 10 to 2.2M                | 1, 2, 5            | 100                                                      | 50                                                           | 100                                                    |
| MSPxxx05               | A       | 0.20                                            | 10 to 2.2M                | 1, 2, 5            | 100                                                      | 150                                                          | 100                                                    |
| MSPxxx05               | C       | 0.25                                            | 10 to 2.2M                | 1, 2, 5            | 100                                                      | 150                                                          | 100                                                    |

## Notes

<sup>(1)</sup> Tighter tracking available

<sup>(2)</sup>  $\pm 2 \%$  standard,  $\pm 1 \%$  and  $\pm 5 \%$  available

<sup>(3)</sup> Continuous working voltage shall be  $\sqrt{P \times R}$  or maximum working voltage, whichever is less

## GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: MSP06A031K00GDA (preferred part numbering format)

| GLOBAL MODEL | PIN COUNT                                             | PACKAGE HEIGHT                     | SCHEMATIC                                    | RESISTANCE VALUE                                                                                                                                  | TOLERANCE CODE                                                                             | PACKAGING                                        | SPECIAL                                                                     |
|--------------|-------------------------------------------------------|------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------|
| MSP          | 06 = 6 pin<br>08 = 8 pin<br>09 = 9 pin<br>10 = 10 pin | A = "A" profile<br>C = "C" profile | 01 = Bussed<br>03 = Isolated<br>00 = Special | R = $\Omega$<br>K = k $\Omega$<br>M = M $\Omega$<br>10R0 = 10 $\Omega$<br>33K0 = 33 k $\Omega$<br>1M00 = 1 M $\Omega$<br>0000 = 0 $\Omega$ Jumper | F = $\pm 1 \%$<br>G = $\pm 2 \%$<br>J = $\pm 5 \%$<br>S = Special<br>Z = 0 $\Omega$ Jumper | EJ = Lead (Pb)-free, tube<br>DA = Tin/lead, tube | Blank = Standard (Dash Number) (Up to 3 digits) From 1 to 999 as applicable |

Historical Part Number Example: MSP06A03102G (will continue to be accepted)

| MSP              | 06        | A              | 03        | 102              | G              | D03       |
|------------------|-----------|----------------|-----------|------------------|----------------|-----------|
| HISTORICAL MODEL | PIN COUNT | PACKAGE HEIGHT | SCHEMATIC | RESISTANCE VALUE | TOLERANCE CODE | PACKAGING |

New Global Part Numbering: MSP08C05131AGDA (preferred part numbering format)

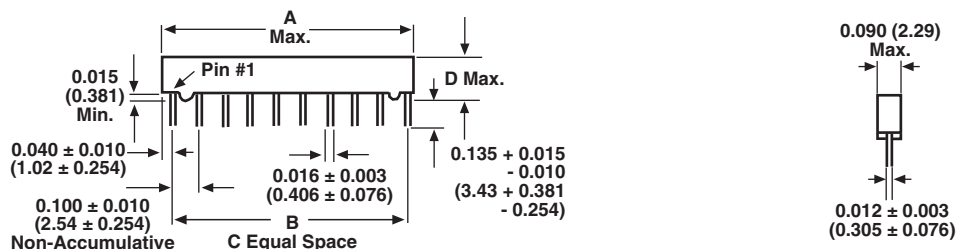
| GLOBAL MODEL | PIN COUNT                                             | PACKAGE HEIGHT                     | SCHEMATIC            | RESISTANCE VALUE                                                               | TOLERANCE CODE                                     | PACKAGING                                        | SPECIAL                                                                     |
|--------------|-------------------------------------------------------|------------------------------------|----------------------|--------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------|
| MSP          | 06 = 6 pin<br>08 = 8 pin<br>09 = 9 pin<br>10 = 10 pin | A = "A" profile<br>C = "C" profile | 05 = Dual terminator | 3 digit impedance code, followed by alpha modifier (see Impedance Codes table) | F = $\pm 1 \%$<br>G = $\pm 2 \%$<br>J = $\pm 5 \%$ | EJ = Lead (Pb)-free, tube<br>DA = Tin/lead, tube | Blank = Standard (Dash Number) (Up to 3 digits) From 1 to 999 as applicable |

Historical Part Number Example: MSP08C05221331G (will continue to be accepted)

| MSP              | 08        | C              | 05        | 221                | 331                | G              | D03       |
|------------------|-----------|----------------|-----------|--------------------|--------------------|----------------|-----------|
| HISTORICAL MODEL | PIN COUNT | PACKAGE HEIGHT | SCHEMATIC | RESISTANCE VALUE 1 | RESISTANCE VALUE 2 | TOLERANCE CODE | PACKAGING |

## Note

- For additional information on packaging, refer to the Through-Hole Network Packaging document ([www.vishay.com/doc?31542](http://www.vishay.com/doc?31542)).

**DIMENSIONS** in inches (millimeters)


| GLOBAL MODEL | A (Max.)      | B             | C | D (Max.)                                       |
|--------------|---------------|---------------|---|------------------------------------------------|
| MSP06        | 0.590 (14.99) | 0.500 (12.70) | 5 | MSPxxA = 0.195 (4.95)<br>MSPxxC = 0.350 (8.89) |
| MSP08        | 0.790 (20.07) | 0.700 (17.78) | 7 |                                                |
| MSP10        | 0.990 (25.15) | 0.900 (22.86) | 9 |                                                |
| MSP09        | 0.890 (22.61) | 0.800 (20.32) | 8 | 0.195 (4.95) only                              |

**TECHNICAL SPECIFICATIONS**

| PARAMETER                                            | UNIT             | MSP SERIES          |
|------------------------------------------------------|------------------|---------------------|
| Package Power Rating<br>Maximum at +25 °C and +70 °C |                  | See Derating Curves |
| Voltage Coefficient of Resistance                    | V <sub>eff</sub> | < 50 ppm typical    |
| Dielectric Strength                                  | V <sub>AC</sub>  | 200                 |
| Isolation Resistance (03 Schematic)                  | Ω                | > 100 M             |
| Operating Temperature Range                          | °C               | -55 to +125         |
| Storage Temperature Range                            | °C               | -55 to +150         |

**MECHANICAL SPECIFICATIONS**

|                                |                                                                                                                                  |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Marking Resistance to Solvents | Permanency testing per MIL-STD-202, Method 215                                                                                   |
| Solderability                  | Per MIL-STD-202, Method 208E, RMA flux                                                                                           |
| Body                           | Molded epoxy                                                                                                                     |
| Terminals                      | Copper alloy, solder plated                                                                                                      |
| Weight                         | MSP06A = 0.4 g      MSP06C = 0.7 g<br>MSP08A = 0.5 g      MSP08C = 0.9 g<br>MSP09A = 0.55 g     MSP10C = 1.1 g<br>MSP10A = 0.6 g |

**IMPEDANCE CODES**

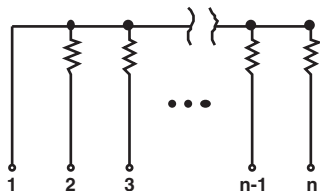
| CODE | R <sub>1</sub> (Ω) | R <sub>2</sub> (Ω) | CODE | R <sub>1</sub> (Ω) | R <sub>2</sub> (Ω) |
|------|--------------------|--------------------|------|--------------------|--------------------|
| 500B | 82                 | 130                | 141A | 270                | 270                |
| 750B | 120                | 200                | 181A | 330                | 390                |
| 800C | 130                | 210                | 191A | 330                | 470                |
| 990A | 160                | 260                | 221B | 330                | 680                |
| 101C | 180                | 240                | 281B | 560                | 560                |
| 111C | 180                | 270                | 381B | 560                | 1.2K               |
| 121B | 180                | 390                | 501C | 620                | 2.7K               |
| 121C | 220                | 270                | 102A | 1.5K               | 3.3K               |
| 131A | 220                | 330                | 202B | 3K                 | 6.2K               |

**Note**

- For additional impedance codes, refer to the Dual Terminator Impedance Code Table document ([www.vishay.com/doc?31530](http://www.vishay.com/doc?31530)).

## CIRCUIT APPLICATIONS

### 01 Schematic



5, 7, 8 <sup>(1)</sup>, or 9 resistors with one pin common

The MSPxxx01 circuit contains 5, 7, 8 <sup>(1)</sup>, or 9 nominally equal resistors, each connected between a common pin (pin no. 1) and a discrete PC board pin. Commonly used in the following applications:

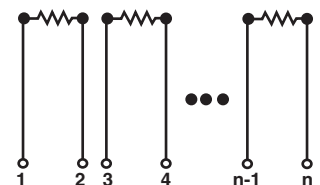
- “Wired OR” Pull-up
- Power Gate Pull-up
- TTL Input Pull-down
- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- TTL Unused Gate Pull-up

#### Note

<sup>(1)</sup> Available in “A” Profile only

Standard E-24 resistance values stocked. Consult factory.

### 03 Schematic

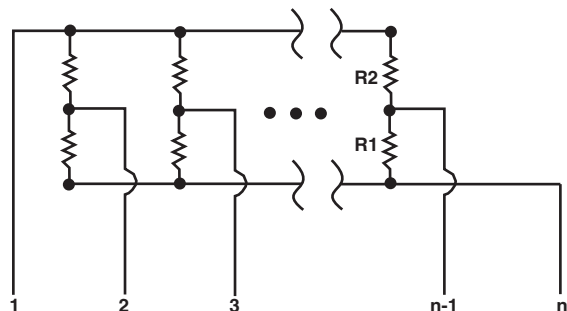


3, 4 or 5 isolated resistors

The MSPxxx03 circuit contains 3, 4, or 5 resistors of nominally equal value in a compact package. Each resistor is connected to two discrete PC pins.

Standard E-24 resistance values stocked. Consult factory.

### 05 Schematic



Pulse squaring and TTL dual-line terminators

The MSPxxx05 circuits contain 4, 6, 7 <sup>(2)</sup>, or 8 series pair of resistors. Each series pair is connected between two common lines. The junction of these resistor pairs is connected to the input terminals.

The 05 circuits are designed for TTL dual-line termination and pulse squaring.

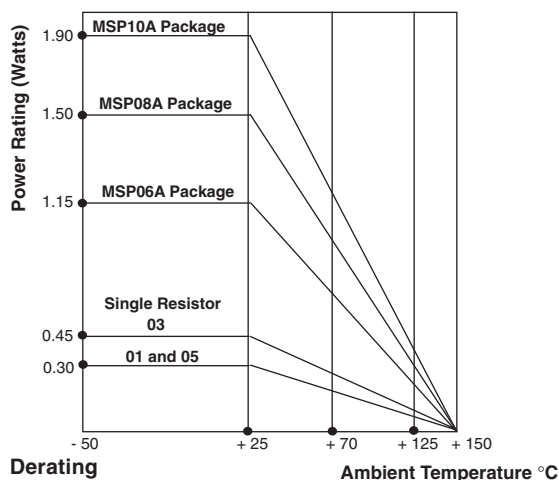
#### Note

<sup>(2)</sup> Available in “A” Profile only

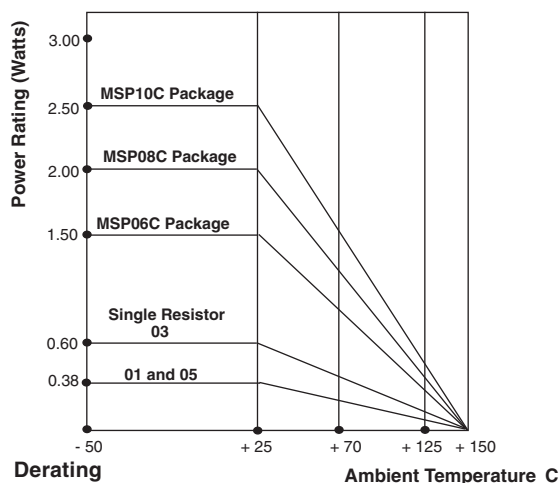
Many dual terminator resistance values stocked. Consult factory.

## DERATING

### “A” Profile



### “C” Profile



**“A” PROFILE +70 °C PACKAGE RATINGS**

|        |        |
|--------|--------|
| MSP10A | 1.25 W |
| MSP09A | 1.12 W |
| MSP08A | 1.00 W |
| MSP06A | 0.75 W |

**“C” PROFILE +70 °C PACKAGE RATINGS**

|        |        |
|--------|--------|
| MSP10C | 1.60 W |
| MSP08C | 1.30 W |
| MSP06C | 1.00 W |

**Note**

- Higher power ratings available. Contact factory.

**PERFORMANCE**

| TEST                            | CONDITIONS                                                                                                               | MAX. $\Delta R$<br>(TYPICAL TEST LOTS) |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Power Conditioning              | 1.5 x rated power, applied 1.5 h “ON” and 0.5 h “OFF”<br>for 100 h $\pm$ 4 h at +25 °C ambient temperature               | $\pm$ 0.50 % $\Delta R$                |
| Thermal Shock                   | 5 cycles between -65 °C and +125 °C                                                                                      | $\pm$ 0.50 % $\Delta R$                |
| Short Time Overload             | 2.5 x rated working voltage 5 s                                                                                          | $\pm$ 0.25 % $\Delta R$                |
| Low Temperature Operation       | 45 min at full rated working voltage at -65 °C                                                                           | $\pm$ 0.25 % $\Delta R$                |
| Moisture Resistance             | 240 h with humidity ranging from 80 % RH to 98 % RH                                                                      | $\pm$ 0.50 % $\Delta R$                |
| Resistance to Soldering Heat    | Leads immersed in +260 °C solder to within 1/16" of device body for 10 s                                                 | $\pm$ 0.25 % $\Delta R$                |
| Shock                           | Total of 18 shocks at 100 g's                                                                                            | $\pm$ 0.25 % $\Delta R$                |
| Vibration                       | 12 h at maximum of 20 g's between 10 Hz and 2000 Hz                                                                      | $\pm$ 0.25 % $\Delta R$                |
| Load Life                       | 1000 h at +70 °C, rated power applied 1.5 h “ON”, 0.5 h “OFF”<br>for full 1000 h period. Derated according to the curve. | $\pm$ 1.00 % $\Delta R$                |
| Terminal Strength               | 4.5 pound pull for 30 s                                                                                                  | $\pm$ 0.25 % $\Delta R$                |
| Insulation Resistance           | 10 000 M $\Omega$ (minimum)                                                                                              | -                                      |
| Dielectric Withstanding Voltage | -                                                                                                                        | -                                      |



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**